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Detection of breast cancer using functionalized Fe-Au nanomaterial synthesized using novel method

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Magnetic nanomaterials due to their physicochemical properties have arsenal of applications in fields of biology and medicine such as magnetic targeting, magnetic resonance imaging, immunoassays, RNA and DNA purification and cell separation and purification. The interplay between nanomaterials and biological systems forms an emerging research field of broad importance. In the recent time, magnetic nanomaterials have received attention because of its tunable super magnetic property. With surface modification, nanomaterials can be functionalized using biomolecules, like antibodies. With advantage of tunable magnetic properties, one can purify protein or biomaterial and can also quantify using SPR properties of nanomaterial. In this study, we have synthesized iron oxide-gold nanoparticles using novel route and characterized using Scanning Electron Microscopy (SEM), UV visible spectroscopy, Fourier Transform Infrared Spectroscopy (FTIR) and X- ray Diffraction (XRD). The elemental and oxidation states of nanoparticles were investigated using X-ray photoelectron spectroscopy (XPS). In further study, a novel Fe-AnNP functionalized using folic acid. As folic acid specifically binds to breast cancer marker which can be pulled down using magnetic field applied in specific direction. This system can isolate breast cancer cells with least possible time and lowest sample required volume. We expect that the combination of unique structural characteristics and integrated functions of multicomponent magnetic nanoparticles will lead to new opportunities in nanobased disease diagnostics. This study can extrapolate in diagnosing various cancers or other diseases.

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Design of experiment aided formulation development and optimization of nanostructured lipid carriers of asenapine maleate

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Oral route is ideal and much preferred over other routes for antipsychotic drug administration because of improved patient compliance. Asenapine Maleate (ASPM) is a novel antipsychotic agent which undergoes extensive first pass metabolism making the oral route inconvenient using conventional dosage form. Therefore, the current study aims to prepare nanostructured lipid carriers (NLCs) of ASPM for intestinal lymphatic uptake to increase its oral bioavailability. Systematic screening of excipients was carried out followed by inclusion of statistical experimental design (DoE) approach for optimization of various process parameters. Placket-Burman design was employed in initial screening of significant independent factors followed by optimization of level of significant factors by Box-Behnken response surface methodology. NLCs of ASPM were prepared by ultrasound dispersion method and characterized for average particle size, polydispersity index (PDI) and zeta potential (ZP) (by Nano ZS, Malvern Instruments, UK), entrapment efficiency (EE) (by HPLC) and shape and surface morphology (by TEM). Drug release studies were conducted by dialysis method. Drug-excipient compatibility was investigated by DSC and FTIR and change in crystallinity was studied by DSC and XRD. The DoE approach was successful in optimization of parameters and the optimized NLCs formulation showed an average size of 84.91±2.14 nm, PDI of 0.222±0.026, ZP of -4.83±0.29 mV and EE of 86.9±1.8%. DSC and XRD studies indicated the amorphized nature of ASPM in lipid matrix. *In vitro* release study indicated the sustained release from NLCs (88.4% in 48 h) compared to plain drug solution (96.3% in 4 h).

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